Canopy Composition and Soil Characteristics of Fall-line Sandhill Communities

Kathryn Madden[1], Rebecca Sharitz[1], Donald Imm[2] , Steve Harper[1]

[1]University of Georgia's Savannah River Ecology Laboratory

[2]USDA-Forest Service Savannah River

Our research objectives are addressing the question:

Is management of longleaf pine woodlands to promote RCW habitat on military installations in the Fall Line region beneficial or detrimental to sandhills communities and the suite of TES they contain?

1. ***At the landscape level*:** To assess whether military training and forest management to promote RCW habitat are appropriate for sandhills communities

2. ***At the species population level***: To determine how the combination of forest management practices and military use that is suitable for the sandhills habitat affects individual TES, such as the gopher tortoise and sandhills plant species

Preliminary Objectives

*** Identify discriminating Fall-line sandhill community characteristics supporting habitat for plant and animal TES**

Select a suite of Herpetofauna and Plants of Conservation Concern known to occur on Fort Benning, Fort Gordon, Savannah River Site

Herps

Gopher tortoise

Southern hognose snake

Pine snake

Plants

Sandhills milk-vetch

Lance-leaf wild indigo

Sandy-woods chaffhead

Woody goldenrod

Sandhills gay-feather

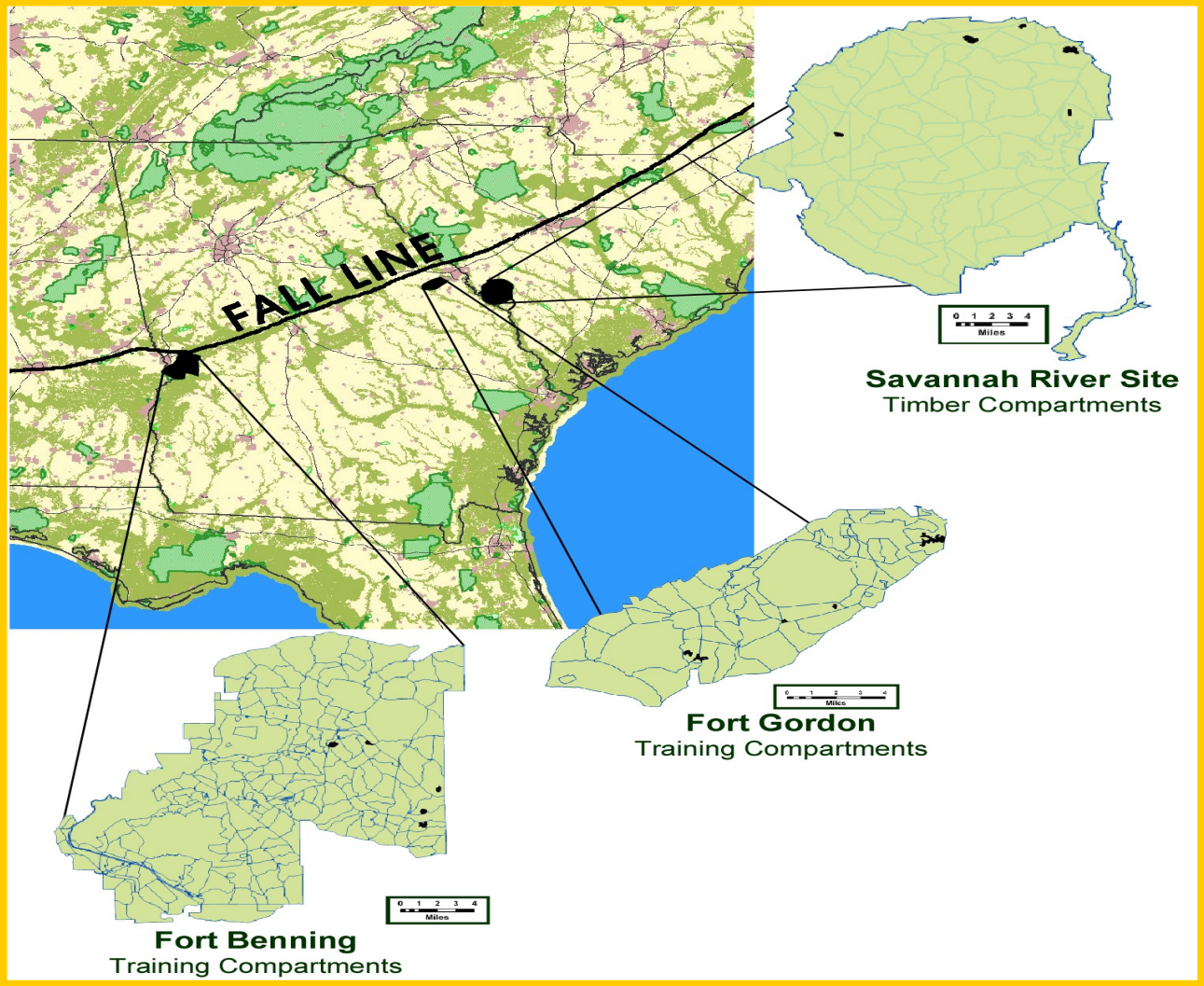
Sandhill lily

Sandhills bean

Pickering's morning-glory

Sandhill-cress

Study Sites


FALL LINE
0 1 2 3 4
Miles
Savannah River Site
Timber Compartments
Fort Gordon
Training Compartments
Fort Benning
Training Compartments

Background

Within the Fall-line Sandhill Region

Pine-oak woodlands / Xeric sandhills historically known as having

-canopy of Longleaf pine and Turkey oak

-nutrient poor soils, excessively drained, and of deep sand

Field Site Selection

Delineated large contiguous areas with similar landscape patterns

Pine component

Deciduous component

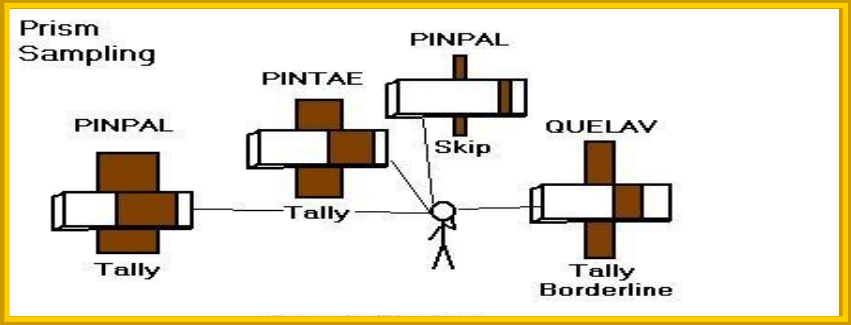
Bare ground component

Number of Sites	
F. Benning	14
F. Gordon	17
SRS	12
Total	*43*

10 random sample points per si

Methods of Canopy Sampling

Prism method



Prism (5x) to measure trees arou
sample point

Species names and dbh recorded

Plotless technique

More information at one point

Hemispherical photographs

One meter above forest floor

Measure of canopy
openness

Methods of Soil Sampling

At each sample point three cores pulled, 50cm or deeper

Soil Texture

-% Soil moisture

50g weighed, oven dried 24hrs

-% Sand, % Silt, % Clay

50g + 4g sodium metaphosphate + 500mL di-water, shaker table 24hrs;

pour into volumetric colander add 500mL di-water

take initial hydrometer reading, 2hrs later final reading and temperature;

Macronutrient, total carbon, total nitrogen

Combined per site, 20cm above and 20cm below

Macronutrient analysis by MS-spectrometer

Total carbon, total nitrogen by combustion method

Preformed by College of Agricultural & Environmental Science, Soils, Plant, and Water Laboratory, Athens, Ga.

Methods of Analyses

Canopy species importance values were generated for each field site

High levels of variance between and among sites per installation

Therefore:

-Cluster analysis (Bray-Curtis) for groupings

-Discriminant Analysis to validate groupings

-Non-metric Multidimensional Scaling (NMDS) to ordinate sites

-Duncan's Multiple Range Test for significant difference between groupings (canopy species, soil moisture, texture, and nutrient content)

Preliminary Results

***Cluster analysis*:** eight groups

Groups	1	8	5	4	3	6	2	7	
Number of Sites	*7*	*3*	*5*	*8*	*7*	*2*	*10*	*1*	
Longleaf pine	48.7	68. *	9.2	12.4	31.0	14.0	72. *	7.0	*no difference groups 2 a
Loblolly pine	1.7	2.7	4.0	56.1	28.7	9.0	5.4	2.0	
Turkey oak	36. *	17.7	59.0	18.1	8.0	8.0	6.8	2.0	*no difference groups 4 a
Bluejack oak	1.0	5.3	12. *	6.4	2.9		1.3	8.0	*no difference groups 3, 4
Sandpost oak	6.9	1.0	2.4	1.8	3.2	24.5	3.1		
Southern red oa	0.4	1.0	1.8	0.4	7.1 *	0.5	1.3		*no difference groups 2, 5
Hickory sp	0.7			0.4	1.6	25.5	0.9		
Post oak	0.3		1.2		1.9	0.5	0.2		
Persimmon	0.7				0.1	1.0	0.5		
Black gum	0.7				1.9		0.2		
Sparkleberry	0.7				0.1		0.3		
Hawthorn	0.1	0.7	7.0		1.6	0.5		2.0	
Sand laurel oak	1.6	0.7	2.4	2.0				2.0	
Shortleaf pine				0.4	2.9	4.5 *	1.5		*no difference groups 2 a
Slash pine			0.4				2.1	76.0	
Dogwood				0.3	0.9	3.0 *	0.8		*no difference groups 2 a
Black oak				0.4	1.3	4.0			
Blackjack oak					0.6	3.5	0.7		
White oak					0.3		0.3		
Water oak				0.4	3.8		0.2	2.0	
Sourwood					0.3				
Cherry			1.0	0.8	1.0		0.9		
Sassafras							1.0		

Discriminant Analysis Results of Groups

Group	1	2	3	4	5	6	7	8
1	s 5	2	0	0	0	0	0	
	71.43	28.57	0.00	0.00	0.00	0.00	0.00	0.0
2	2	4	3	0	0	0	0	
	20.00	40.00	30.00	0.00	0.00	0.00	0.00	10.0
3	1	1	4	1	0	0	0	
	14.29	14.29	57.14	14.29	0.00	0.00	0.00	0.0
4	0	0	0	8	0	0	0	
	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.0
5	1	0	0	0	3	0	0	
	20.00	0.00	0.00	0.00	60.00	0.00	0.00	20.0
6	0	0	0	0	0	2	0	
	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.0
7	0	1	0	0	0	0	0	
	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.0
8	1	0	0	0	0	0	0	
	33.33	0.00	0.00	0.00	0.00	0.00	0.00	66.6
Total	10	8	7	9	3	2	0	
	23.26	18.60	16.28	20.93	6.98	4.65	0.00	9.3

Canopy Openness and Soil Results

Canopy Openness (sample average per group)

	Group 1	Group 8	Group 5	Group 4	Group 3	Group 6	Group 2	Group 7
Number of Sites	*7*	*3*	*5*	*8*	*7*	*2*	*10*	*1*
%Canopy Openness	28.8	39.1	67.8	32.5	33.3	16.6	35.1	25.3

moisture and soil texture per group (sample average per group) significant values underlin

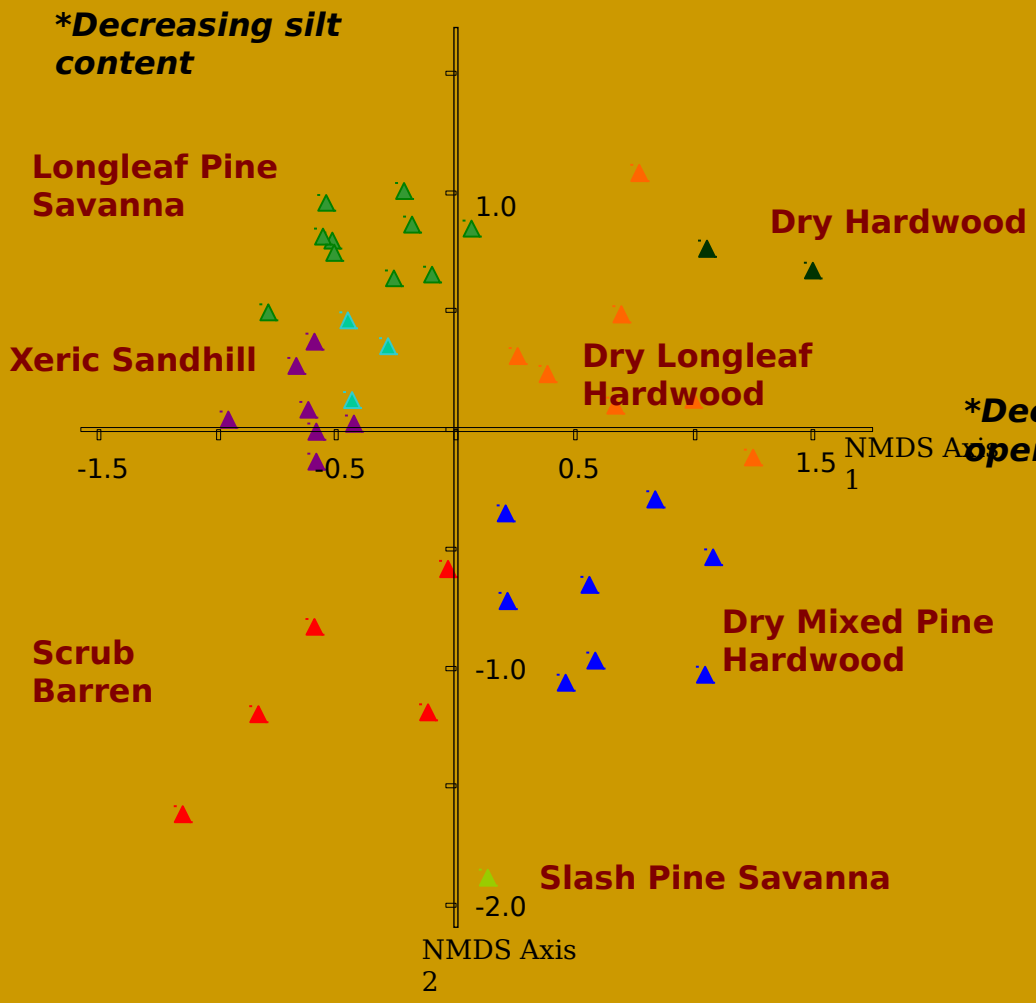
	Group 1	Group 8	Group 5	Group 4	Group 3	Group 6	Group 2	Group 7	
Number of Sites	*7*	*3*	*5*	*8*	*7*	*2*	*10*	*1*	
%Moisture	4.9	5.4	5.4	4.1	7.1	5.9	7.3	0.8	
%Sand	95.4*	95.2*	94.3	93.9	92.1	90.9	91.9	92.2	*no difference groups 4 a
%Clay	2.6	3.4	3.8	4.2	5.5	6.1	6.2	6.3*	*no difference groups 2,
%Silt	2	1.4	1.9	1.9	2.4	2.9	1.8	1.5	

Soil nutrient per group (sample average per group) significant values underlined

0-20 cm	Group 1	Group 8	Group 5	Group 4	Group 3	Group 6	Group 2	Group 7	
Number of Sites	*7*	*3*	*5*	*8*	*7*	*2*	*10*	*1*	
Ca ppm	12.9	22.4	28.9	22.1	27.1	81	27.1	19.3	
Mg ppm	2.3	3.3	3.4	2.8	4.3	13.6	4.4	2.9	
Mn ppm	1.8	2.2	3.7	3.0	4.4	12.1	3.7	4.5	
K ppm	8.8	8.7	10.8	8.2	10	13.4*	9.9	7.3	*no difference groups 2, 3
P ppm	2.4	1.9	1.3	2.0	2.3	3.7	2.0	3.1	
% C	0.7	0.6	0.6	0.9	0.7	1.0	0.7	0.7	
% N	0.02	0.02	0.02	0.03	0.02	0.04	0.02	0.02	
pH	4.5	4.5	5.0*	4.7	4.8	4.9	4.5	4.7	*no difference groups 3, 4

NMDS Ordination of Sites per Group

	*Axis 1	*Axis 2
R^2	0.64	0.44
F-value	3.609	1.591
P-value	0.002	0.144



*Decreasing sand content and canopy openness

Increasing soil moisture and pH

Preliminary Conclusions

	Xeric Sandhills Groups 1, 8	Scrub Barrens Group 5	Dry Pine-Hardwoods Groups 3, 4	Dry Pine Savanna Groups 2, 7	Dry Hardwood Group 6
SRS	5	0	2	4	1
Ft Gordon	4	0	8	5	0
Ft Benning	1	5	5	2	1
Total	10	5	15	11	2

Field site selection methods resulted in a range of sites across the three installations with similar landscape patterns and varied tree canopy composition which may be attributed to very slight changes in soil composition and moisture availability

Variation in soil composition may be attributed to factors such as topography, intensities of disturbance, regime of burning and management activities

These data will help to predict occurrence of pine-oak woodlands and xeric sandhill communities on a landscape level

Current Field Activities

This baseline characterization data will be compared with other on going surveys

Currently, surveying known populations of selected plant and animal sandhill TES species occurring on all three installations

Surveys include:

-Measuring canopy and herbaceous composition,

-Soil texture,

-TES plant and animal densities,

-Measurements indicating TES plant and animal health and productivity

-Measurements of burrow commensals

Thank You

DoD EPA DOE SERDP Strategic Environmental Research and Development Program

The University of Georgia Savannah River Ecology Laboratory

Forest Service US Department of Agriculture

Pine snake
(Pituophis melanoleucus)

Gopher tortoise
(Gopherus polyphemus)

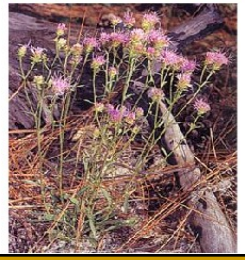
Sandhill cress
(Warea cuneifolia)

Pickering's morning glory
(Stylisma pickeringii)

Red-cockaded woodpecker
(Picoides borealis)

Sandhill lily
(Nolina georgiana)

Sandy-woods chaffhead
(Carphephorus bellidifolius)



Southern hognose snake
(Heterodon simus)

Lance-leaf wild indigo
(Baptisia lanceolata)

Sandhills gay-feather
(Liatris secunda)